EMERGENCY BLOW PIPE LINE OF MAIN BALLAST TANKS

Description and Maintenance Instructions

H641-A76-222

CONTENTS

I. DESCRIPTION

A. APPLICATION AND BASIC CHARACTERISTICS

The emergency blow system employs high pressure air to blow the following tanks:

1. The midship group of main ballast tanks Nos 5 and 6 when the submarine rises to diving trim.
2. All the main ballast tanks in case of damage or when the submarine should rapidly rise to full buoyancy.
3. Separate main ballast tanks to correct emergency trim and list.
4. The negative tank to perform fast dive of the submarine.

The pipe line of the system is worked in bimetallic pipes 42x5 (0.8) and 28x3.5 (0.8) connected through unions with red copper corrugated gaskets and in red copper pipes 6x1.5 connected through unions with paronite gaskets.

The fittings of the pipe lines are made of brass; the union connections for bimetallic pipes are made of steel, while those for the red copper pipes are made of brass.

The pipe line of the main ballast tank blow system assembled with the fittings has been tested for tightness under an air pressure of P=200 kgf/sq.cm.

The negative tank blow pipe line together with the negative tank has been tested for tightness under an air pressure of P=5 kgf/sq.cm.

B. GENERAL DESCRIPTION AND DESCRIPTION OF INDIVIDUAL UNITS
(See Diagram, Appendix 1)

The MBT emergency blow system includes: manifolds, hull shut-off valves with one and two non-return valves, non-return valves, interlocking valves, spool valves (connected with the hydraulic units), pressure gauges and pipes with joints.

[illegible] blowing panels situated [illegible] in compartment III [illegible] compartments I and VII.

Main [illegible]

The main [illegible] air for blowing the main ballast tanks [illegible] control room and consists of three manifolds [illegible] intended for blowing the fore, midship and aft groups of the ballast tanks, respectively.

Air to the [illegible] manifolds is fed from the main distributing manifold of the HP air system through valves 52, 56 and 61.

Each manifold has six shut-off valves, four of which are connected with the tanks; valves 52, 56 and 61 are the common shut-off valves of the manifolds. The spaces under these valves communicate with each other and with the main distributing manifold of the HP air system through piping.

Valves 7 are used for blowing the manifolds.

When blowing the fore group of ballast tanks the [illegible] from manifold 18 flows [illegible] pipes:

from valve [illegible]

from valve [illegible] terlocking valve [illegible]

from valve [illegible] to both the sides;

from valve [illegible] interlocking [illegible] sides.

When blowing [illegible] manifold 17 flows [illegible]

from valves [illegible] and 53 to both the sides;

from valves [illegible] and 49 to both the sides.

When blowing the aft group of [illegible] flows along the pipes:

from valve 51 to [illegible] through non-return valve 48, interlocking valves [illegible] and 46 to both the sides;

from valve 50 to No.8 tank through non-return valve 45, interlocking valves 5 and hull valves 27 and 43 to both the sides;

from valve 24 to No.9 tank through non-return valve 29, interlocking valves 5 and hull valves 33 and 36 to both the sides;

from valve 23 to No.10 tank through hull valves 34 and 35 to both the sides.

Hull valves 3, 10, 21, 25, 26, 27, 33, 36, 43, 46, 49, 53, 63, 75 are shut-off valves and have one non-return valve each, the pipes being connected to the valves to feed air to the respective tanks.

Hull valves 1, 2, 9, 34, 35, 65 are also shut-off valves and have two non-return valves each, the air supply pipes being connected to the valves.

The non-return valves in the hull shut-off valves are designed to prevent the ballast tank water from entering the emergency blow pipe line.

Stand-By Blowing Panel in Compartment I

Air from the HP air pipe line is fed through valves 71 and 74 to distributing manifold 73 sited in compartment I.

The distributing manifold has seven valves. Valve 71 is a common shut-off valve of the manifold, valve 7 is intended for blowing the manifold.

When blowing the fore group of ballast tanks, air from manifold 73 flows along the pipes:

from valve 68 to No.1 tank through hull valves 1 and 2 to both the sides and to No.2 tank through non-return valve 4, interlocking valve 5 and hull valves 3 and 75 to both the sides;

from valve 67 to No.3 tank through hull valves 9 and 10 to both the sides;

from valve 66 to No.4 tank through non-return valve 64, interlocking valves 5 and hull valves 21 and 63 to both the sides.

When blowing the midship group of ballast tanks, air from manifold 73 flows along the pipe line from valve 69 through

non-return valve 62 to manifold 17, to under-valve space of shut-off valve 56; in this case non-return valve 54 prevents air from entering the main which interconnects manifolds 17 and 40.

Air from manifold 17 enters tanks Nos 5 and 6 similarly as when blowing the tanks from compartment III.

When blowing the aft group of ballast tanks air from manifold 73 flows along the pipe line from valve 70 to manifold 40 and then along the pipes:

from valve 28 to No.7 tank through non-return valve 47, interlocking valves 5, hull valves 26 and 46 to both the sides;

from valve 31 to No.8 tank through non-return valve 44, interlocking valve 5, hull valves 27 and 43 to both the sides;

from valve 30 to No.9 tank through non-return valve 32, interlocking valves 5 and hull valves 33 and 36 to both the sides;

from valve 30 to No.10 tank through hull valves 34 and 35 to both the sides.

Stand-By Blowing Panel
in Compartment VII

Distributing manifold 40 is arranged in compartment VII. Air to the distributing manifold is fed through valves 37 and 39 from the HP air pipe line.

The distributing manifold has seven valves. Valve 39 is a common shut-off valve of the manifold, valve 7 is intended for blowing the manifold.

When blowing the aft group of ballast tanks, air from manifold 40 flows along the pipes to tanks Nos 7, 8, 9 and 10 similarly as when blowing the aft group of tanks from compartment I in emergency.

When blowing the midship group of ballast tanks, air from manifold 40 flows along the pipe line from valve 42 through non-return valve 54 to manifold 17 to the under-valve space of shut-off valve 56. In this case non-return valve 62 prevents air from entering the main which interconnects manifolds 17 and 73.

From manifold 17 air flows to tanks Nos 5 and 6 similarly as when blowing the tanks from compartment III.

When blowing the fore group of tanks, air from manifold 40 flows along the pipe line from valve 41 to manifold 73 and then flows to tanks Nos 1, 2, 3, 4 in the same way as during emergency blowing the fore group of tanks from compartment I.

Negative Tank Blow Pipe Line

Air to the negative tank is fed from the HP air system along the pipe line through valve 60 seated in the control room.

Air supply is checked by pressure gauge 58 placed on the tank vent pipe. The same pipe mounts safety valve 59.

Fittings

Valve Manifolds
(See Appendix 2)

The blow manifolds (See Refs 12, 17, 22, 40 and 73 in Diagram) are identical in construction and differ in the number of valves seated on them. The blow manifolds are used to feed air to the emergency blow pipe line. The manifolds consist of shut-off valves.

All the shut-off valves (see Appendix 2), except for the [illegible] valves, are constructed as follows:

Manifold body 1 has a taper saddle to which disc 2 is [illegible]. Disc 2 is connected with stem 3 and intermediate bushing 4 screwed into cover 5.

Handwheel 6 is fitted on the stem. When the handwheel is [illegible] the stem makes the intermediate bushing rotate. While [illegible] on the cover along the thread the bushing lifts or [illegible] the valve disc.

The cover is screwed into the body and is packed with copper gasket 8. Packing of the stem is effected by lapping the head of the stem to the cover and by using celluloid gasket 7.

The blow valves are of standard construction.

Hull shut-off valve with
Two Non-Return Valves
(See Appendix 3)

This valve (Refs 1, 2, 9, 34, 35, 65 in Diagram) is used to supply air to the tank and consists of body 1 which houses a standard shut-off valve described above and two non-return valves.

Each of the non-return valves consists of non-return valves 3 with rubber packing ring 2 pressed against the saddle by spring 4 fitted on the guide of spring disc 5.

When the submarine is submerged, non-return valve 3 is pressed by the sea pressure to the saddle of the non-return valve.

When blowing the tank, the air overcomes the pressure of the spring and the back-pressure of the sea water and releases the non-return valve.

The valves (Refs 3, 10, 21, 25, 26, 27, 33, 36, 43. 46, 49, 53, 63, 75 in Diagram) differ from the above valve in that each of them has one non-return valve.

Safety Valve

The safety valve(Ref. 59 in Diagram)is used to prevent excess pressure in the system. The valve is seated on the vent pipe of the negative tank and is adjusted at a popping pressure of $P_{popping}$ = 26 kgf/sq.cm.

Pneumatically Operated Interlocking Valve
(See Appendix 4)

The valve (Ref. 5 in Diagram) is located on the emergency blow pipe line of [illegible] and is used to prevent air from entering the tank when the kingston valves shut.

When the kingston valve is shut, the return valve is also shut and no air will flow to the above tank.

The valve includes the following parts: body 1, disc 2 with packing 7 and rest 3, piston 5 and stem 4.

Interlocking of blowing the fuel-ballast tanks is effected as follows:

When blowing a fuel ballast tank with its kingston valve shut, the air from the emergency blow manifold flows to the interlocking valve, passes the holes in disc 2 and presses the disc to the saddle by passing the fuel-ballast tank.

Through the hole in plug 9 along the pipe "a" (See the Connection Diagram) the HP air flows to the spool valve seated on the hydraulic unit.

With the kingston valve shut, the spool valve stops the HP air flow to the space above piston 5 of the interlocking valve and provides communication between the above-piston space with the compartment through the pipe "б" and through the hole in the spool valve body.

When the kingston valve is opened, at the end of the hydraulic unit travel, the projection on its ram resting against the tappet of the spool valve makes the disc shift, thus letting the HP air flow along the pipe "б" to the space above piston 5 of the interlocking valve. Simultaneously the other disc shuts the hole by which this space communicates with the compartment. The pressure of air on piston 5 overcomes the pressure of the spring and the pressure of air on disc 2, as a result the interlocking valve gets opened and the air flows to the fuel-ballast tank.

Spool Valve
(See Appendix 5)

The spool valve (Ref. 6 in Diagram) is used to control the interlocking valve. This consists of the following principal parts: double-saddle body 1, two discs 4, adjustable tappet 6 and intermediate stem 8.

For operation of the spool valve see order "Pneumatically Operated Interlocking Valve".

Angle Non-Return Valve
(See Appendix 6)

The non-return valve (Ref. [illegible], [illegible], 12, [illegible], 45, 54, [illegible] Diagram) is designed to let the air flow in one di-

rection only. The valve is constructed as follows: body 1 has a saddle with packing ring 7 which is connected with non-return valve 5 through screw 6.

The non-return valve is pressed against the saddle of the body with the aid of spring 4 fitted on the guide of the non-return valve.

The other end of the spring rests against the base of the seat of plug 2.

... State ... Equipment	Normal working pressure of system / Limit working pressure (red line)	Location	Remarks
3	4	5	6
MTK 100Bx400/200	up to 200 kgf/sq.cm 200 kgf/sq.cm.	Compartment III, on board of HP air station	
MTK 100Bx400/200	up to 200 kgf/sq.cm 200 kgf/sq.cm	Compartment I, near emergency blow manifold	
MTK 100Bx400/200	up to 200 kgf/sq.cm 200 kgf/sq.cm	Compartment VII, near emergency blow manifold	

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3	4	5	6
MTK 100Bx40/25	up to 25 kgf/sq.cm 25 kgf/sq.cm	Compartment III, on board of HP air station	

II. MAINTENANCE INSTRUCTIONS

A. GENERAL SUPERVISION AND UPKEEP

1. See to it that the pipe lines, their joints and fittings be perfectly tight; immediately eliminate troubles, if any.

Special attention shall be given to the proper condition of the seals of the pressure gauges and those of the safety valves.

2. Under any condition the hull valves with the non-return valves shall be in the open (adjusted) position and sealed. The valves are adjusted and the notches are made during adjustment of the system. Every month blow the emergency blow pipe lines.

N o t e s: 1. During first test blowing, check the hull blow valves for adjustment to ensure surfacing of the submarine without list and with no change in trim.

2. After turning the valve, set the indicator against the notch corresponding to the position of the valve adjusted; this done, seal the valve.

...ATION FOR OPERATION

...tion of the fittings when at base or at sea:

... 73;

...ce shut and sealed;

..., 70 are open and sealed;

... 51, 55

6. Blow valves 7 on the manifolds are open when the submarine is anchored at base, and shut when at sea.

7. All the hull valves are adjusted in the open position and sealed.

8. Valve 60 is shut.

9. Air from the HP air distributing manifold is supplied to the emergency blow manifolds.

C. PUTTING INTO ACTION, DURING-OPERATION MAINTENANCE AND STOPPING

General

10. To avoid excess consumption of the compressed air, start blowing ballast tanks Nos 5 and 6 before the submarine starts surfacing, which is to be determined by the depth gauges.

The rest of the tanks shall be blown with low pressure, after the submarine has risen to diving trim.

11. In case of emergency, the air shall be fed to the ballast tanks until the latter are blown completely.

For blowing the tanks strictly observe the Instructions for diving and surfacing.

12. After blowing, bring the system to the initial position and bleed the air from the system through blow valves 7 on the manifolds.

CAUTION: 1. When fuel-ballast tanks Nos 2, 4, 7, 8 and 9 are filled with fuel, valves 66 and 68 on manifold 73, valves 13, 15 on manifold 12, valves 34, 50 and 51 on manifold 22 and valves 28, 30, 31 on manifold 40 shall be shut and sealed.

2. All the shut-off valves shall be opened smoothly without jerks and shocks.

Main Ballast Tank Blowing

Prior to blowing the main ballast tanks, do the following:

13. Make sure that the vent valves are shut and the kingston valves of the ballast tanks to be blown are open.

14. Read the indications of pressure gauges 38, 57, 72 to make sure that air is supplied to emergency blow manifolds 17, 40, 73.

15. This done, perform the procedures according to Table 2.

16. After blowing, bring the system to the initial position and bleed air from the system through bleeder valves 7 seated on the emergency blow manifold.

Table 2

No.	Groups of tanks to be blown	Check valves on manifolds for opening					Open valves on manifolds					Shut valves on manifolds				
		12	17	22	40	73	12	17	22	40	73	12	17	22	40	73
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Fore, midship and aft groups simultaneously from compartment III	13 14 15 16	18 19 20 55	23 24 50 51			61	56	52							
2	Midship group from compartment III		18 19 20 55					56								
3	Fore group from compartment III	13 14 15 16					61									
4	Aft group from compartment III			23 24 50 51					52							

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
5	Fore, midship and aft groups simultaneously from compartment I		18 19 20 55		[illegible] [illegible] 30 31	[illegible] [illegible] 68 70					69 71					
6	Fore group from compartment I					66 67 68					71					70
7	Midship group from compartment I		18 19 20 55								69 71					66 67 68 70
8	Aft group from compartment I				28 30 31	70					71					66 67 68
9	Aft, midship and fore groups simultaneously from compartment VII		18 19 20 55		28 30 31 41	66 67 68 70				39 42						

17

41 66 67 68 70 39 28 30 31

When blowing separate tanks of the midship, fore or aft groups from any blowing panel, leave open the valve on the manifold of the tank being blown having shut the rest of the valves of this group.

Blowing the Tanks Filled with Fuel in Case of Damage to the Submarine

17. Prior to blowing fuel-ballast tanks Nos 2, 4, 7, 8 and 9 filled with fuel, make sure that the kingston valves of these tanks are open, while their vent valves are shut.

18. Open valves 66, 68 on manifold 73, valves 13, 15 on manifold 12, valves 24, 50 and 51 on manifold 22 and valves 28, 30 and 31 on manifold 40; futheron proceed in accordance with Table 2.

19. For righting trim and list of the surfaced submarine, proceed in accordance with the Instructions for surface damage resistance.

Negative-Tank Blowing

When blowing the negative tank with air, proceed as follows:

20. Make sure that the kingston valve is open and the vent valve is shut.

21. Make sure that air is supplied to shut-off valve 60 [illegible] the shut-off valve on the HP air manifold.

[illegible] to the tank, having opened shut-off valve 60.

[illegible] pressure gauge 58 to make sure that the pressure [illegible] exceed 25 kgf/sq.cm.

[illegible] the light signalling system which will indicate [illegible] of blowing.

[illegible] valve 60.

[illegible] submarine during [illegible] emergency [illegible] condition. In this [illegible] in accordance with [illegible] flow pipe [illegible] valves shut.

Every time prior to disassembling the system, make sure that the pipe line is not under pressure, otherwise disconnect the pipe line and relieve pressure.

For disassembly and reassembly of the joints use two wrenches to maintain tight integrity of the adjacent joints.

E. TROUBLES AND REMEDIES

26. Troubles which are likely to occur and the remedies to be done are tabulated below.

Table 3

No.	Symptom	Probable cause	Remedy
1	Air leaks through closed valves	Poor lapping of valves	Disassemble valves and lap discs
2	System flooded with sea water with submarine submerged	Non-return valves on hull valves leaky	(a) Replace packing ring (b) Replace [illegible]
3	Air leaks through joints	Joints, [illegible]	(a) [illegible] [illegible] (b) [illegible]
4	Air flows through non-return valves to pressure [illegible] tion	Valve [illegible]	[illegible]

F. [illegible]

Daily Inspection

27. See to it that the pipe [illegible] securely tight; inspect the [illegible] and make sure that their [illegible]

28. Turn unsealed valves, [illegible]

Weekly Inspection

Perform the operations of the daily inspection and in addition do the following:

29. Turn and work out all the sealed valves. Work out by hand the interlocking spool valves of the fuel-ballast tank kingston valves.

Monthly Inspection

Perform the procedures of weekly inspection and in addition do the following:

30. During anchorage at base replace packing rings of the leaky valves, if any; if sticky valves fail to be worked out, overhaul them.

Check the non-return valves of the hull valves for tightness through the bleeder valves on the manifolds:

(a) for air leak when surfaced;

(b) for water leak when submerged.

Check the interlocking arrangement of the fuel-ballast tank emergency blow system in action with the kingston valves and vent valves of the fuel-ballast tanks open.

31. Check the safety valve on the negative tank for operation.

Inspection During Running Repair

32. Depending on technical condition, overhaul and lap the hull and shut-off valves.

Overhaul the non-return valves of the hull valves at least once a year.

33. Overhaul and adjust [illegible] valve.

34. [illegible] pressure of [illegible]

When testing [illegible] lows:

(See Diagram, Append[illegible])

1. Shut all the hull valves [illegible] 25, 27, 33, 34, 35, 36, [illegible]

2. Make sure that the blow valves (Ref. 7) on the emergency blow manifold are shut.

3. Open the valves (Refs 13, 14, 15, 16, 18, 19, 20, 23, 24, 29, 30, 31, 41, 42, 50, 51, 55, 66, 67, 68, 69, 70) on the emergency blow manifolds in compartments I, III and VII to feed air to the tanks.

4. Open the HP air supply valves (Refs 39, 52, 56, 61, 71) seated on the emergency blow manifolds.

5. Open the valves (Refs 36, 74) feeding the HP air from the HP manifolds to the emergency blow manifolds.

6. Open the HP supply valves on the HP air manifolds to feed air to the system.

For checking the joints for tightness coat them with soap-suds.

After checking the joints for tightness, remove pressure from the system, for which purpose do the following:

1. Shut the HP air supply valves (Refs. 37, 74) on the HP manifolds and on the emergency blow manifolds.

2. Shut the HP air supply valves (Refs 39, 52, 56, 61, 71) seated on the emergency blow manifold.

3. Open the hull valves with one non-return valve (Refs 3, 10, 21, 25, 26, 27, 33, 34, 35, 36, 43, 46, 49, 53, 63, 75).

4. Open the bleeder valves seated on the emergency blow manifolds (Ref. 7).

CAUTION! To keep the rubber packing of the non-return valves of the hull valves with two valves from damage and from excessive tightening, test the pipe line for tightness with the non-return valves removed.

35. After testing the system for tightness, bring it to initial position (See Items 3-9).

36. The section of the pipe line running from the HP air manifolds as far as the valves (Refs. 42, [illegible]) shall be tested together with the HP air system.

37. The section of the pipe line running from the regulating tank as far as Valve 80 and pressure gauge [illegible] shall be

tested together with the negative tank for tightness under a hydraulic pressure of 28 kgf/sq.cm or an air pressure of 5 kgf/sq.cm.

38. Prior to taking fuel into the fuel-ballast tanks, check operation of the interlocking valves and spool valves; if the fuel-ballast tanks carry no fuel, check these valves every time before putting to sea.

39. Overhaul and lubricate the interlocking gears at least every three months.

CAUTION! For checking the interlocking gears for operation, blow the fuel-ballast tanks with their vent valves open.

40. The diver shall inspect the flood holes and the gratings of the kingston valves of the main ballast tanks, regulating tanks and of the negative tank.

G. REFERENCE DATA

41. The time necessary for blowing the midship ballast tanks for surfacing from the periscope depth is equal to

[illegible] necessary for blowing all the ballast tanks [illegible] periscope depth is 30 sec.

[illegible] air necessary for blowing the [illegible] when surfacing from the

[illegible] which air was taken for [illegible]

[illegible] last tanks when surfacing from the [illegible]

[illegible] all the compressors are used.

47. Two hours are taken for [illegible] which air was taken for blowing [illegible] the ballast tanks

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when surfacing from the [illegible], provided all the compressors are used.

48. Diving System. Description and Operating Instructions M641-A76-169.

49. HP Air System. Description and Operating Instructions.M641-A76-220.

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APPENDICES

SECRET

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Notes:

1. The numerators on the extension lines to the pipes show the design sizes of the pipes, while the denominators indicate the amount of air pressure to be supplied for testing the assembled piping for tightness.
2. The figures at the safety valve show the pressure of popping of the valve

Description	Symbols

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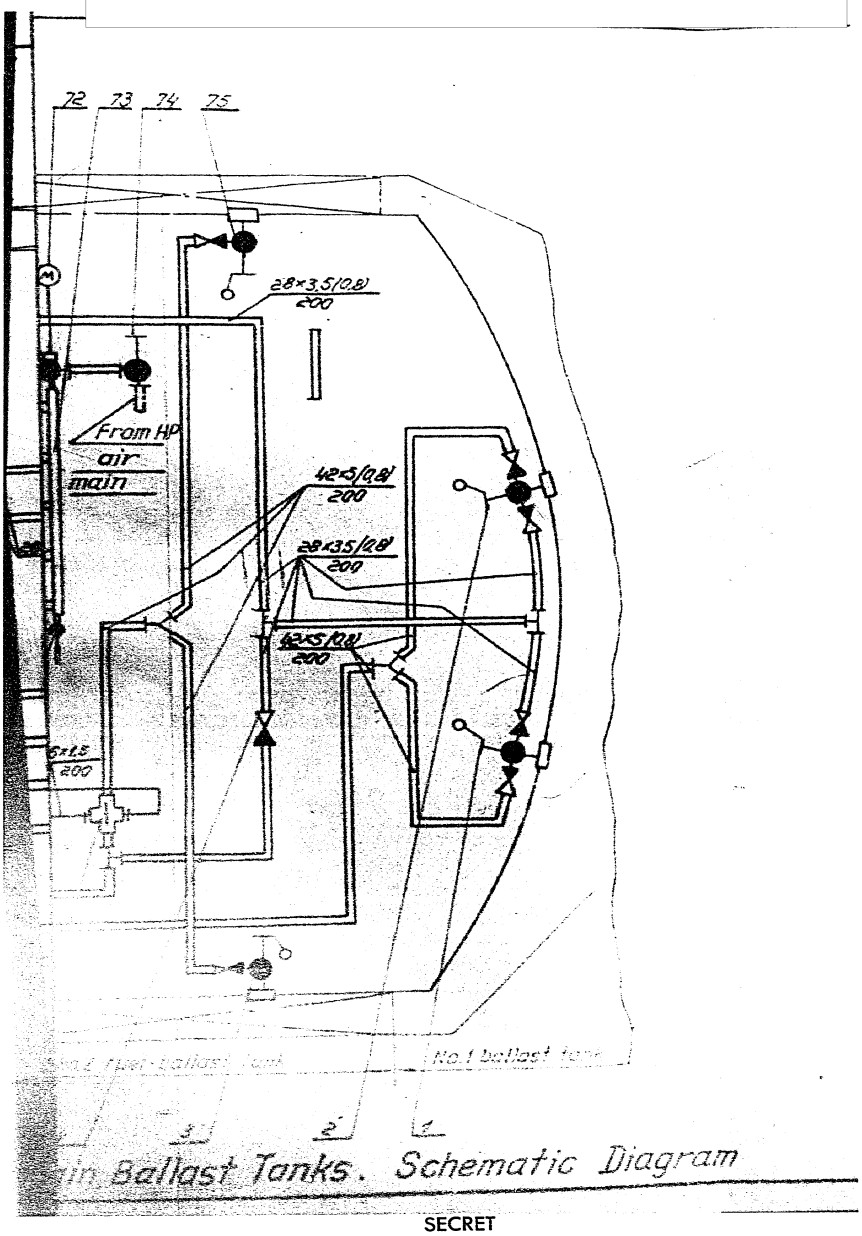

in Ballast Tanks. Schematic Diagram

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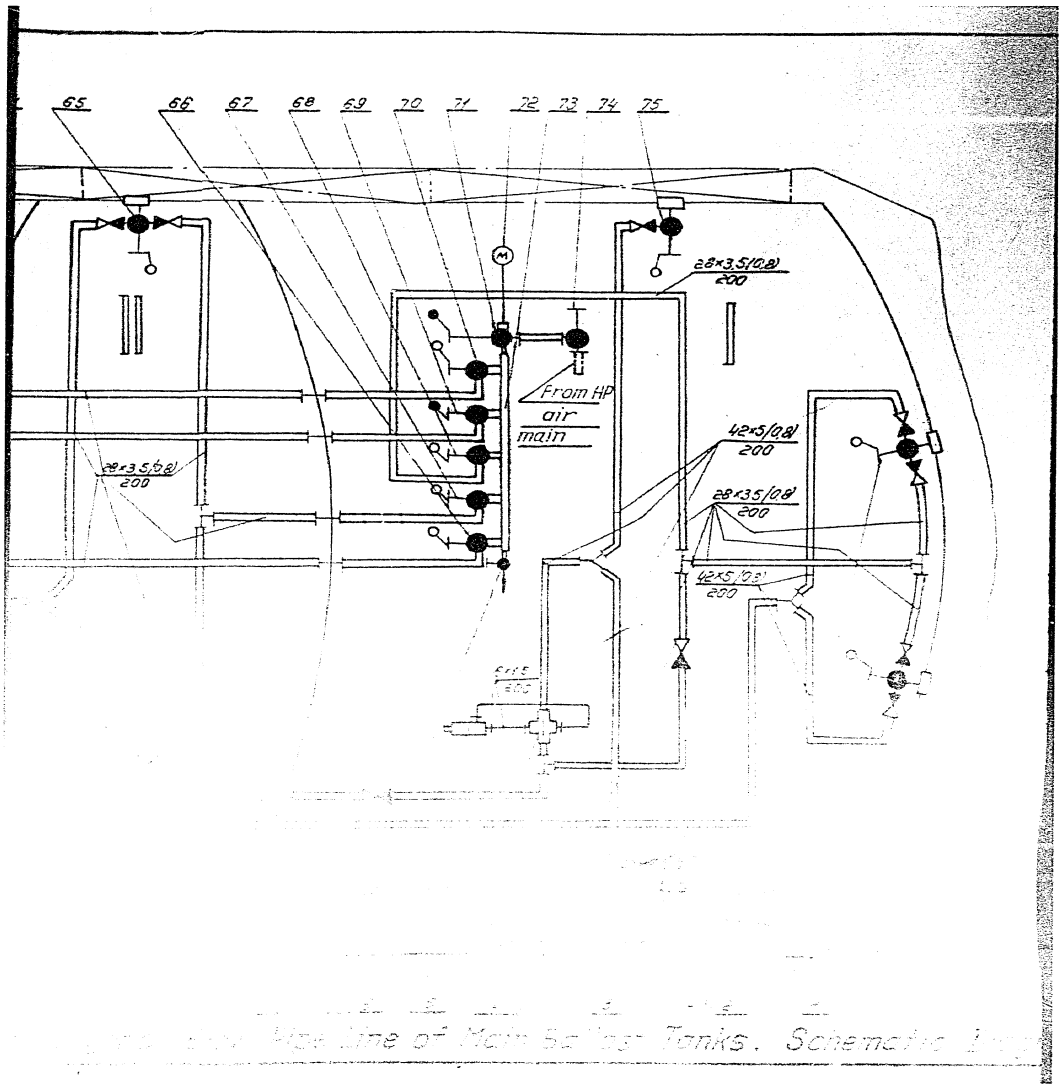

Main Gasoline or Main Water Tanks. Schematic

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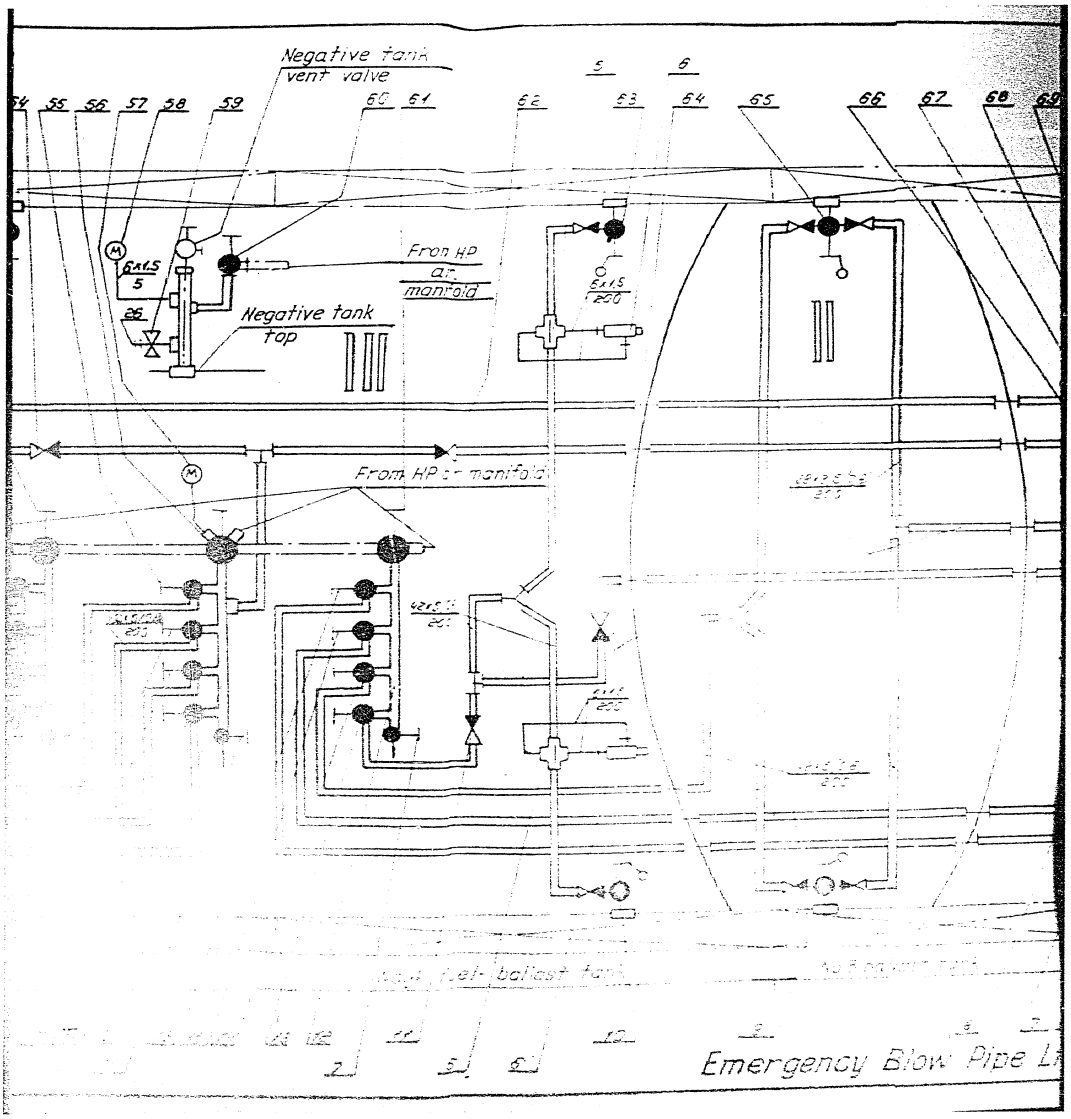

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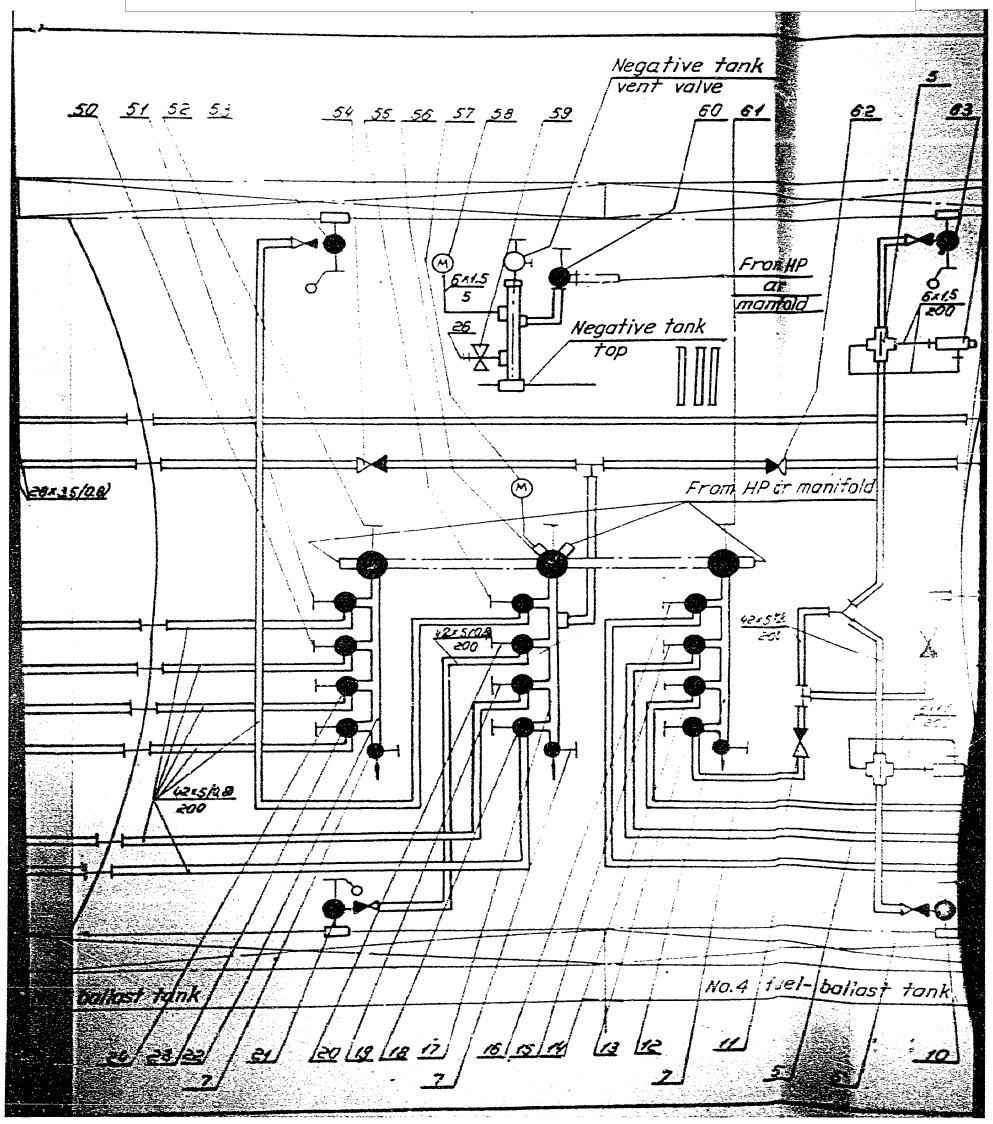

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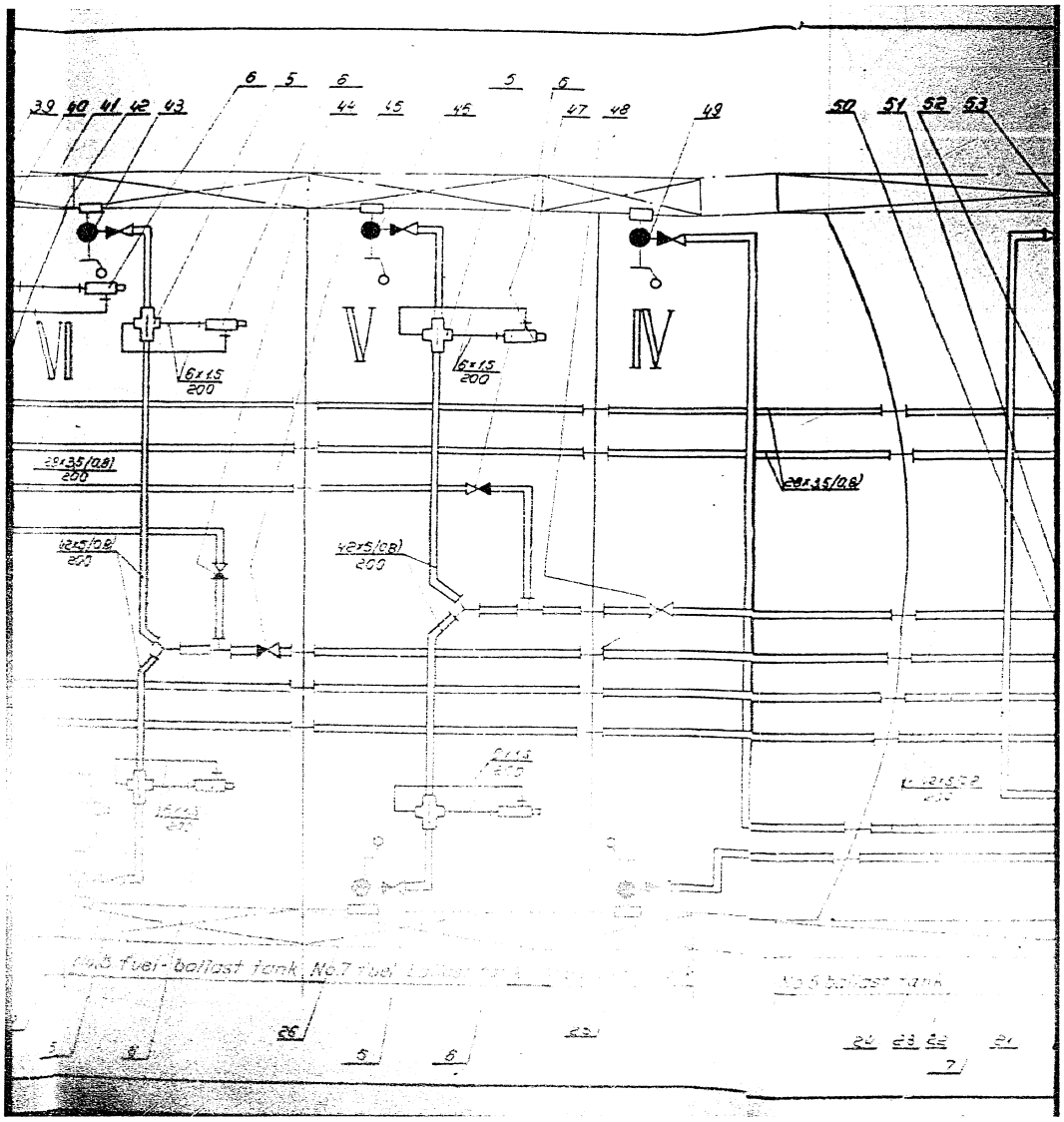

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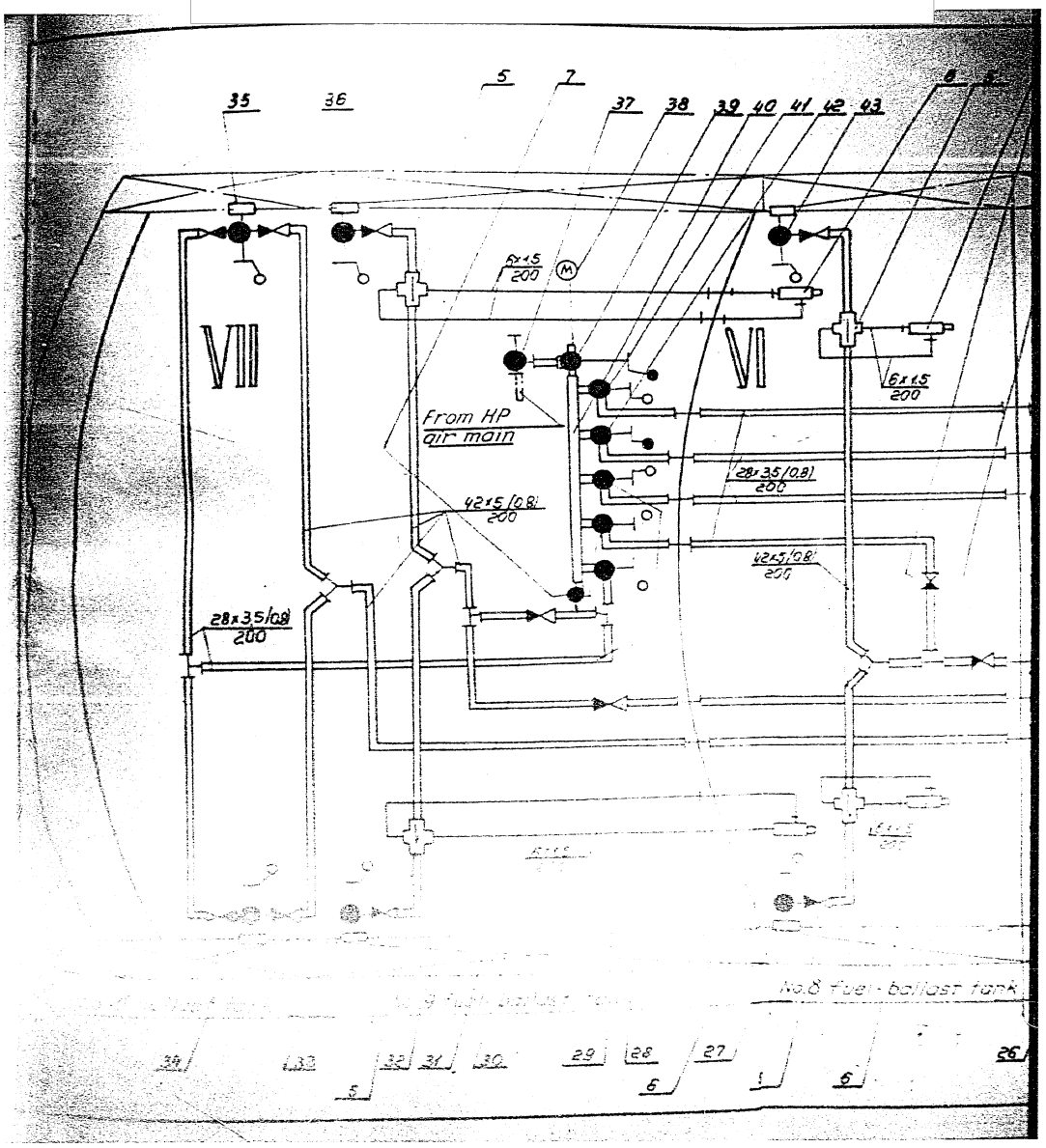

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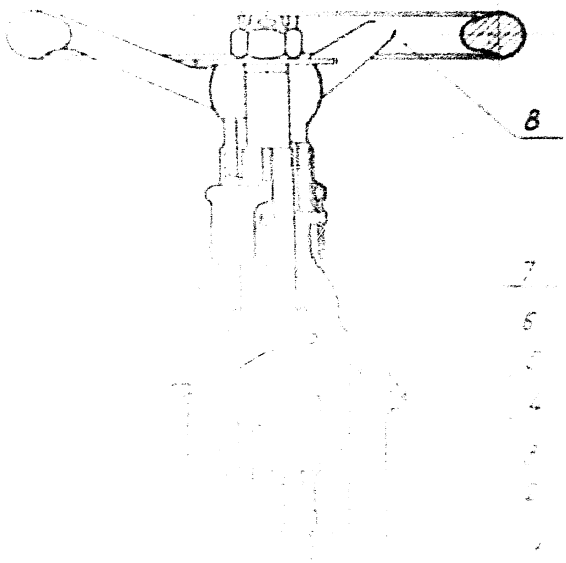
APPENDIX 2



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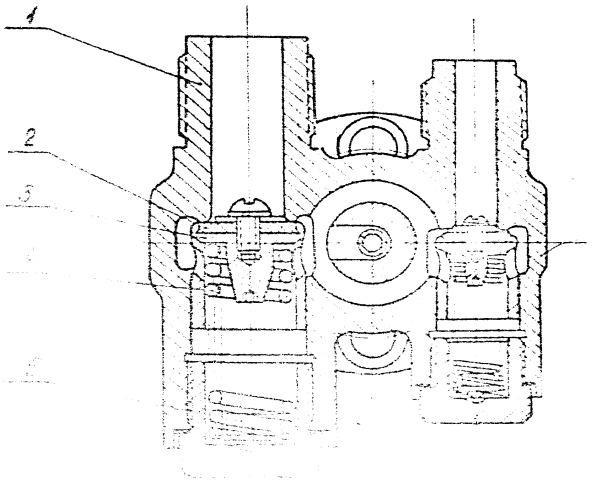
APPENDIX 3

AA Section



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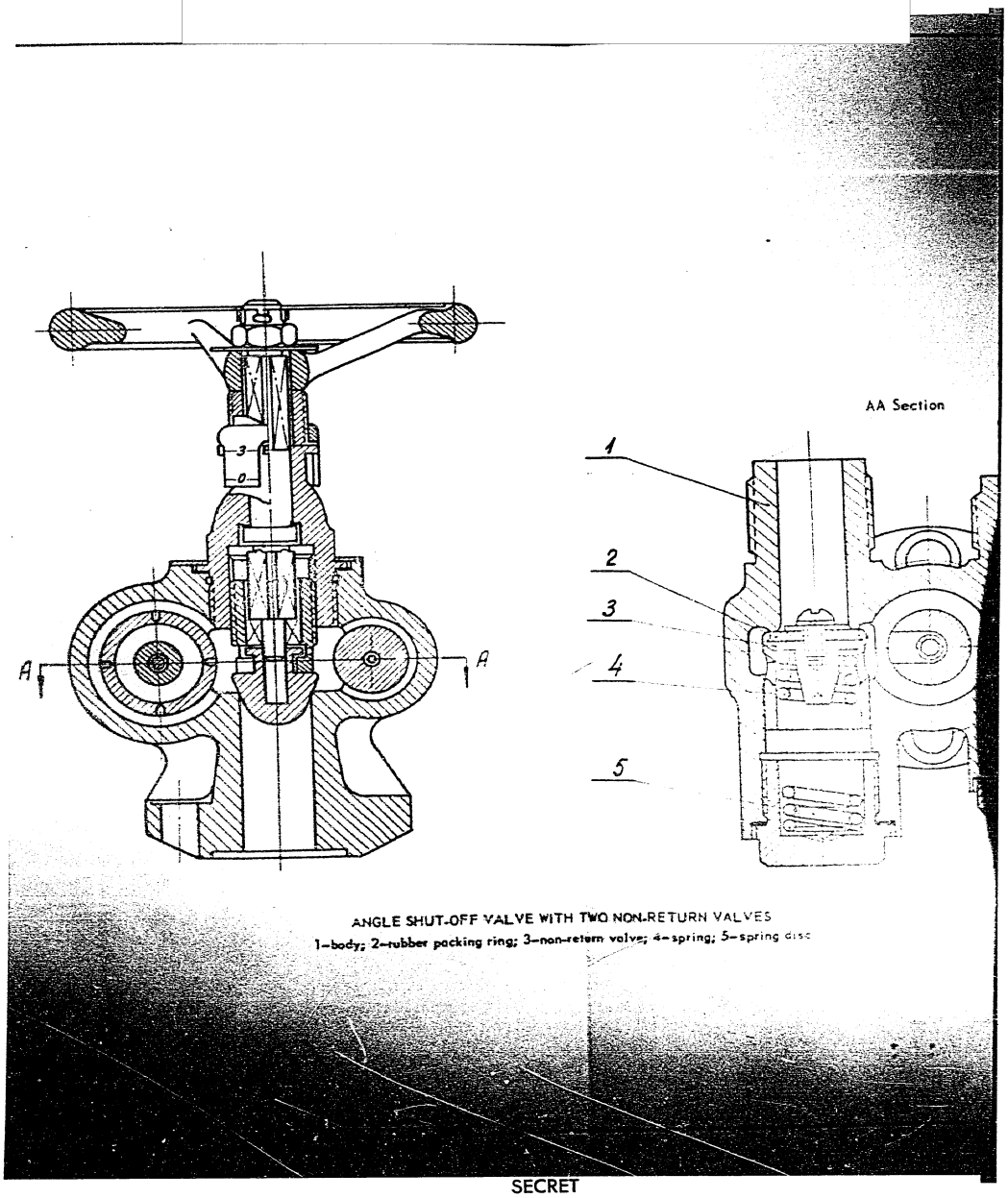

ANGLE SHUT-OFF VALVE WITH TWO NON-RETURN VALVES

1–body; 2–rubber packing ring; 3–non-return valve; 4–spring; 5–spring disc

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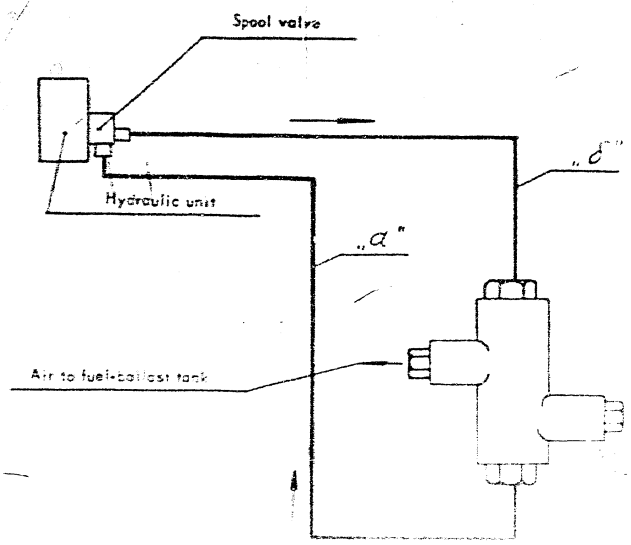
APPENDIX 4

FUEL-BALLAST TANK INTERLOCKING SYSTEM
CONNECTION DIAGRAM



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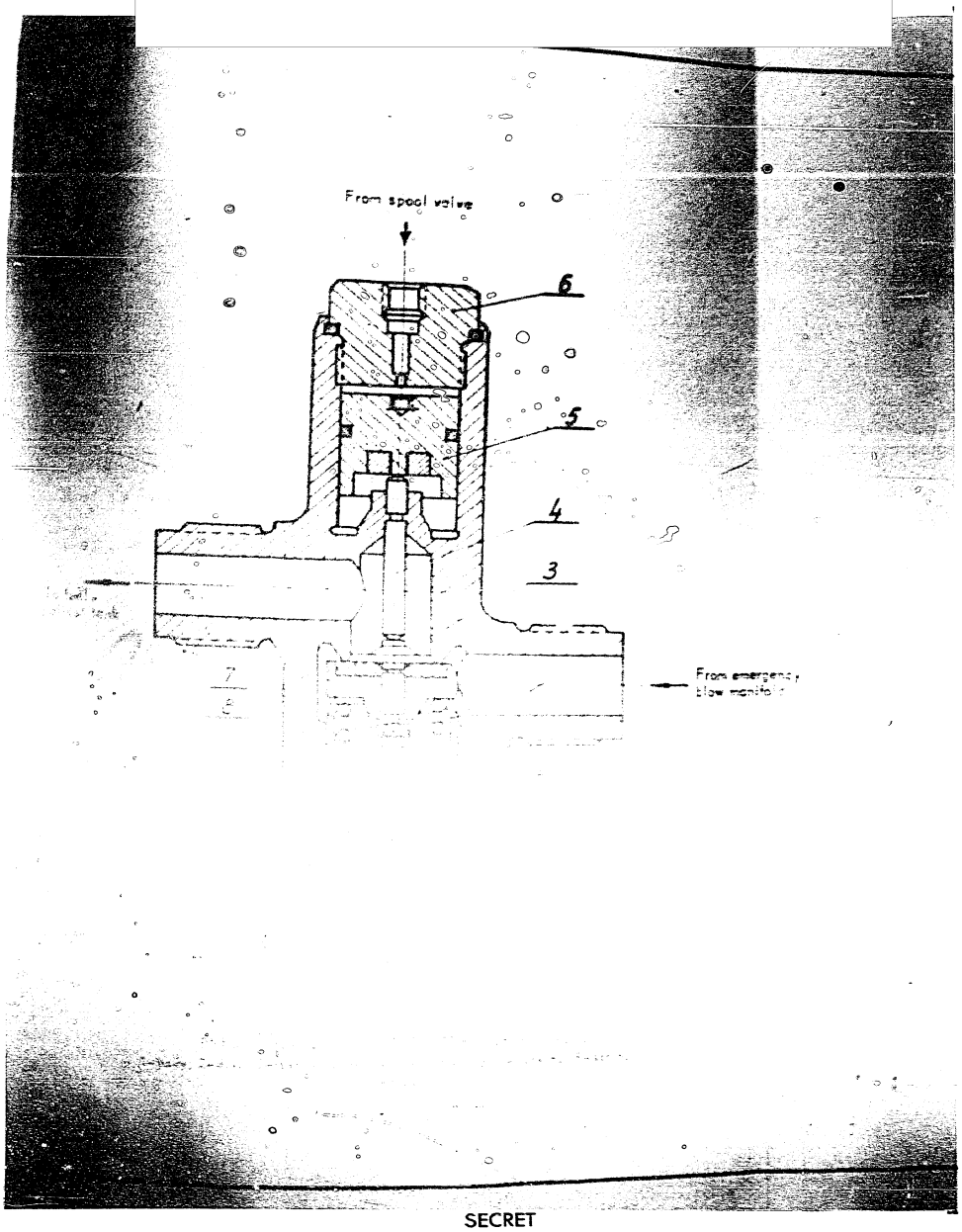

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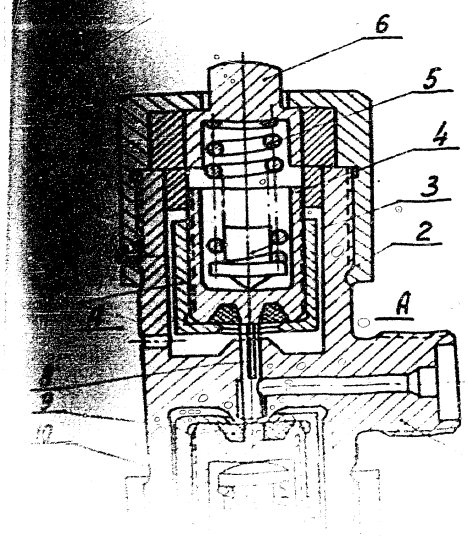
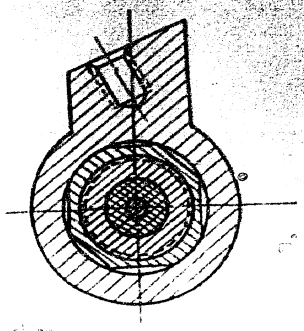
APPENDIX 5



AA Section

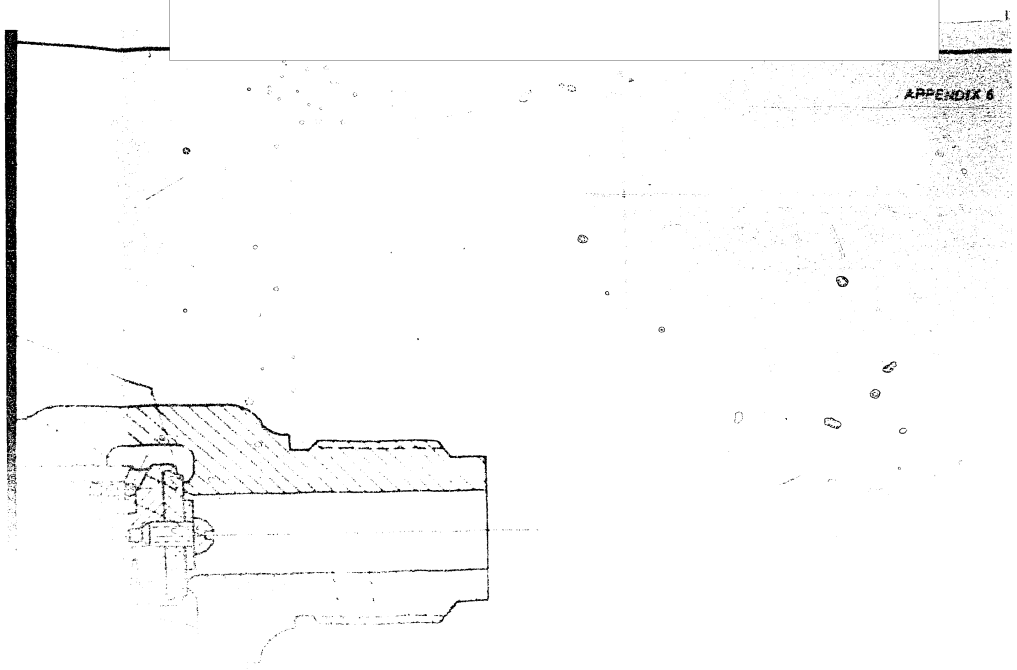


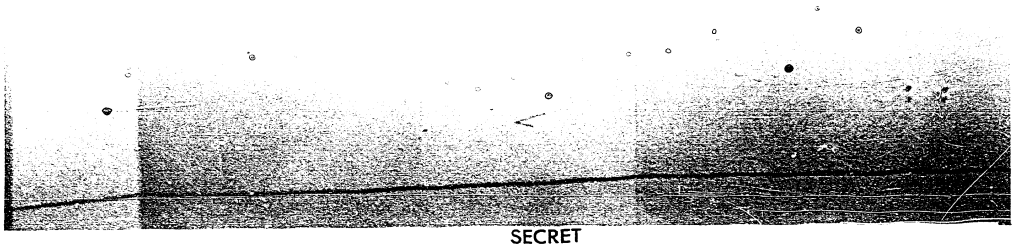
50X1-HUM

50X1-HUM

SECRET

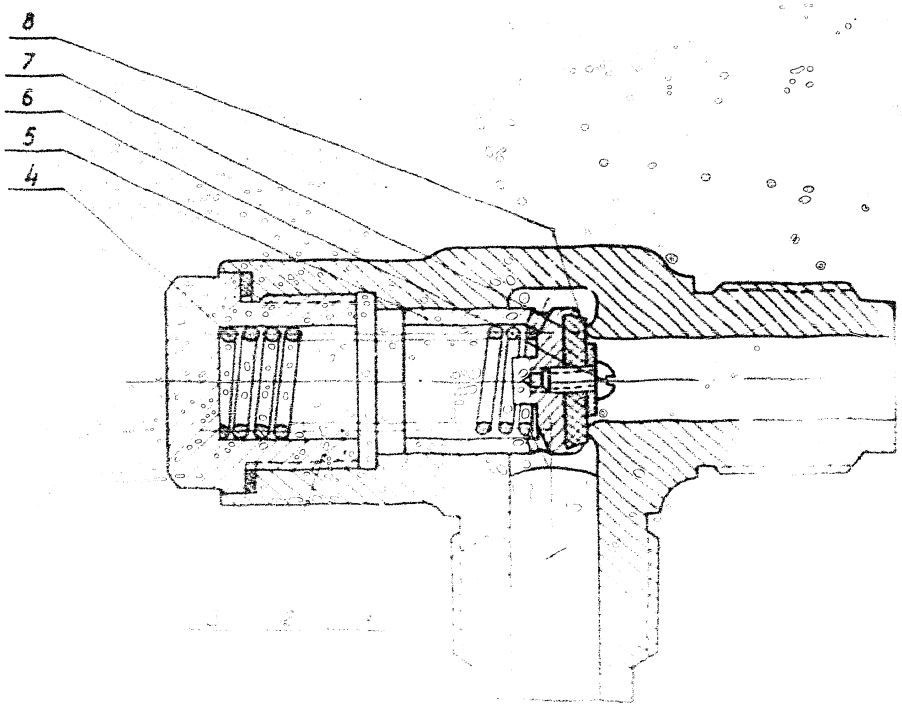
APPENDIX 6





SECRET

50X1-HUM



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